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THE SURGEON'S

Circular Letter

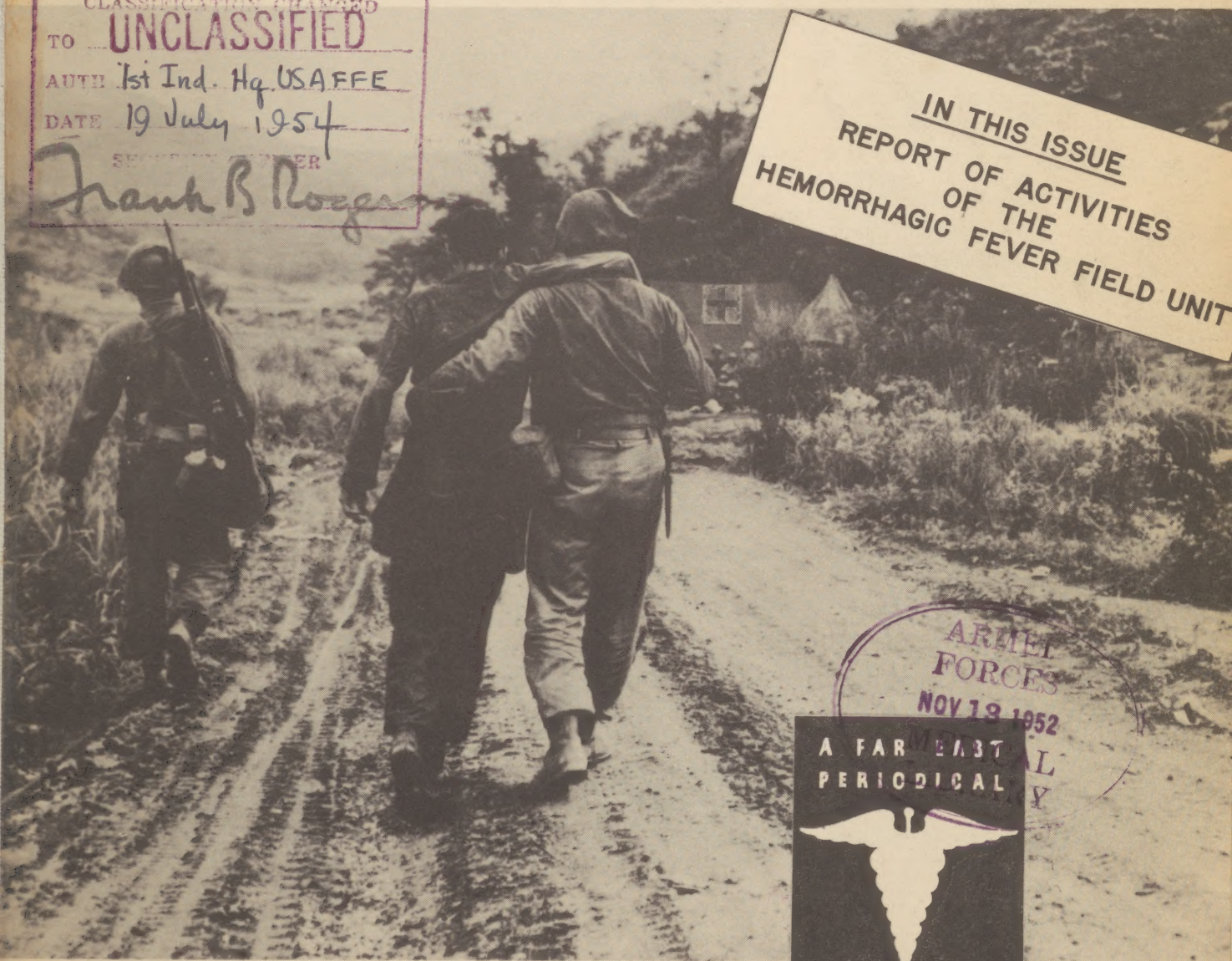
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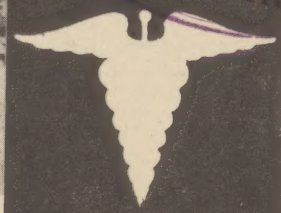
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SUBMITTED BY
Frank B. Rogers

IN THIS ISSUE
REPORT OF ACTIVITIES
OF THE
HEMORRHAGIC FEVER FIELD UNIT



ARMY
FORCES
NOV 13 1952

A FAR EAST
PERIODICAL



OF ARMY
MEDICAL SERVICES

MEDICAL SECTION- HQ-FEC, AND UNC

APO 500

CIVIL SERVICE FOR THE CIVIL POPULATION IN KOREA IS UNDER THE DIRECTION OF U. N. CIVIL ASSISTANCE COMMAND IN KOREA (UNCACK)



1



2



3



4

1. Dr. Charles V. Dukoff, UNCACK, gives public health lecture on "Intestinal Parasites"
2. A Korean doctor and nurse sterilize their hands prior to performing a nephrectomy
3. Staff doctors of the Provincial Hospital
4. Technicians at the hospital make X-rays of a boy's leg with UNCACK allocated equipment
5. Dr. An Yong Il gives patient typhoid vaccine at a Public Health Dispensary in Korea
6. Entranced audience listens to a lecture
7. Pharmacist at Provincial Hospital receives medical supplies from UNCACK representative
8. Dr. Kim Wan Kun examines a tiny girl at the Public Health Center, Cheju-Do, Korea.

6



5



7



8



on the cover

A sergeant from the 23d Infantry Regiment, 2d Infantry Division, helps an exhausted buddy to the Aid Station during the battle for "Old Baldy" near Chorwon, Korea.

(All Photos by U. S. Army Signal Corps)

THE SURGEON'S

Circular
Letter

Volume VII - Number 9

SEPTEMBER 1952

Headquarters

Far East Command

Medical Section

APO 500

ADMINISTRATIVE

Third Northern Command Medical Conference Held at Sendai	134
JLCOM Nurses Conference	134
USDA To Inspect Poultry and Poultry Products	135
Ten-Day Workshop Conducted at Walter Reed Army Medical Center	135
Extension Expiration Date Procaine Penicillin	135
Closure of Syphilis Registers	135
Workshop for Home Nursing Trainers	136
Dosage Dilemma	136
Recent Department of the Army Publications	136

THIRD NORTHERN COMMAND MEDICAL CONFERENCE HELD AT SENDAI

The US Army Hospital, 8166th Army Unit, Camp Sendai, was host for the 3d Northern Command Medical Conference at Sendai on 26 September. The hospital is commanded by Colonel Jonathan M. Rigdon, MC.

The day's activities began with welcoming addresses by Colonel Angvald Vickoren, MC, Deputy Surgeon, JLCOM; Colonel Charles L. Leedham, MC, Consultant in Internal Medicine, Far East Command; and Colonel Rigdon.

The program was unusually varied from the standpoint of the subjects presented, and interesting, well prepared articles were discussed as follows:

"Acute Soft Tissue Injuries to the Knee Joint," by 1st Lt Garry D. Hough, MC, US Army Hospital, Sendai; "Acute Pancreatitis," by Capt Percival C. Lipsett, MC, US Army Hospital, Sendai; "Acute Appendicitis," by 1st Lt Sherman W. Thorpe, MC, US Army Hospital, Sendai; "Management of Foreign Bodies in the Gastro-Intestinal Tract," by 1st Lt Thomas D. Grekin, MC, US Army Hospital, Camp Haugen; "Narcotic Problem in Soldiers," by Dr. Parry Wood, Washington University School of Medicine, Consultant in Internal Medicine to the Surgeon General; "The Malaria Problem in the Northern Command," by Lt Colonel Tillman D. Johnson, MC, US Army Hospital, Sapporo; "Use and Abuse of Antibiotics," by Colonel Ryle A. Radke, MC, Tokyo

Army Hospital; "Predisposing Factors in Chancroid," by Capt Arthur W. Bauman, MC, 24th Division; "Chemotherapy in Chancroid," by 1st Lt George I. Thomas, MC, 45th Medical Detachment; "Prostatic Dysfunction," by Capt William G. Thomas, MC, Headquarters Company, XVI Corps; "Character and Behavior Disorders," by Lt Colonel Philip B. Smith, MC, Osaka Army Hospital; "Colic," by Capt Robert K. Rawers, MC, US Army Hospital, Sendai; "Common Types of Eye Injuries and their Treatment," by 1st Lt Douglas Stiernberg, MC, US Army Hospital, Sendai. The session was climaxed by presentation of a discussion "Procurement and Problems," by Colonel Harold W. Glattly, MC, Chief of Personnel, Office of The Surgeon General, Washington, D. C.

Many compliments were passed concerning the excellence of the program and the standard of professional competence shown in the presentation of technical subjects.

Approximately 70 medical officers from the Northern Command attended the conference in addition to several local Japanese doctors.

Colonel Charles L. Leedham, MC, Lt Colonel Frederick W. Timmerman, MC, Colonel Ryle A. Radke, MC, and Major James H. Johnson, MC, acted as co-chairmen and moderators for the conference.

JLCOM NURSES CONFERENCE

Brigadier General James P. Cooney, Surgeon, Japan Logistical Command, formally opened a two-day conference for Chief Nurses of his Command, held in Yokohama, on September 5th and 6th.

The program gave Japan's Chief Nurses an opportunity to discuss matters of concern pertaining to their respective hospitals, and offered an interesting

panel that provided them with a better understanding of the Army Nurse Service.

The program on Friday, September 5th, included: "A Review of the Overall Picture of Hospital Activities and the Nursing Service," by Colonel Angvald Vickoren; "Public Information and the Army Nurse," by Lt Colonel P. L. McPherran; "The New Nursing Organization,"

by Capt Alice Bender; "Writing the ETMD," by Maj William Davis; "Nursing activities in the Far East Command," by Lt Colonel Alice M. Gritsavage; "Nursing Objectives in Japan," by Miss Matsue Inoui, President, Japan Nursing Organization; "Current Objectives of the Nursing Service in Japan Logistical Command," by

Major Edith Aynes.

On Saturday, September 6th, the program included: "Word from Washington," by Lt Colonel Inez Haynes, and Miss Ellen Aird, Headquarters, American Red Cross Nursing Service; and "The Home Nursing Program," by Miss Ellen Aird.

USDA TO INSPECT POULTRY AND POULTRY PRODUCTS

As a result of a survey of veterinary inspection activities, occasioned by the Thirty-Second Report of the Preparedness Subcommittee of the Committee on Armed Services, United States Senate (11 Nov 51), higher authority has directed that the origin inspection of a portion of certain poultry and poultry products, purchased by the QMCS, be performed by inspectors of the U. S. Department of Agriculture, in the United States only, for a six months' trial period.

Preliminary plans have been made and it is contemplated that the trial period will start on or about 15 October 1952. During this period in a representative number of plants, supplying approximately 25%

of the ready-to-cook poultry and shell eggs in which the USDA maintains continuous inspections of poultry and eggs, the origin inspection will be performed by USDA inspectors. At the end of the trial period, the services of the USDA will be evaluated, a determination made by higher authority whether and to what extent they should be extended.

The designation of the contracts, for which USDA inspection will be used, will be made by the Market Center awarding the contracts.

The Class 4 inspection of the products which are origin inspected by the USDA inspectors, will be performed by the Veterinary Corps in the usual manner.

TEN-DAY WORKSHOP CONDUCTED AT WALTER REED ARMY MEDICAL CENTER

The Army Medical Service recently conducted a ten-day workshop at the Walter Reed Army Medical Center for the faculties of the Army's three co-educational advanced medical technician schools to standardize curriculum and administrative methods for the courses.

This was a final step preliminary to opening two of the schools 27 October, at Letterman Army Hospital and Fitzsimons Army Hospital. The first of the three schools was established at Walter Reed Army Hospital in 1940.

Major General Silas B. Hays, Deputy Army Surgeon, keynoted the sessions on opening day by pointing out the need for the expanding program of training at the

practical nurse level for enlisted men and women to relieve the continuing shortage of professional nurses.

Major General Paul H. Streit, Commanding General of the Center, and medical officers stationed there, participated in the program. Miss Louise Moore, vocational education specialist from the United States Office of Education, and Miss Mabel Montgomery, Vice-president of the American Nurses Association and Executive Secretary of the Virginia Board of Nurse Examiners, were among the speakers. Major Isabelle Mason, director of the Walter Reed advanced medical technician course, served as the workshop moderator.

EXTENSION EXPIRATION DATE PROCAINE PENICILLIN

The following is an extract from DA Cir. 73, 21 August 1952, quoted for information and guidance of all concerned:

"II....PROCAINE PENICILLIN G, FOR AQUEOUS INJECTION, 300,000 AND 1,500,000 UNITS (MEDICAL STOCK NUMBERS 1-607-400 AND 1-607-410). - An 18 months' extension of the current expiration date of standard stocks of

medical stock numbers 1-607-400 Procaïne Penicillin G, for Aqueous Injection, 300,000 Units, and 1-607-410 Procaïne Penicillin G, for Aqueous Injection, 1,500,000 Units is authorized. Accordingly, stocks of the above items should be used until 18 months past the current expiration date shown on the package."

CLOSURE OF SYPHILIS REGISTERS

Numerous instances of non-compliance with current regulations, with regard to the closure of syphilis registers, have been noted for the past several months by the FEC Medical Section. For the information of all officers of the Army Medical Service, paragraph 24c(4)(a), AR 40-210 (C-6), is quoted in part below:

"24. Reports.*** c. Syphilis Register.***(4)Closure. (a) The Syphilis Register will be closed for any one of the reasons mentioned under (2) above. Closure will be made by the medical officer responsible for the care of the individual and the reason for such closure will be indicated in the proper space provided on Page 1. The register will then be forwarded to The Surgeon General with letter of transmittal in triplicate through surgeons of armies or in the case of United States Air Force personnel, through surgeons of major Air Force commands, in the zone of the interior and, in the case of oversea commands, through the command or department surgeons, who will take necessary action to insure that registers are complete and prepared properly prior to forwarding to The Surgeon General. * * * The Commanding Officer of the individual will be notified at once by the medical officer making the closure that the register has been closed and forwarded to The Surgeon General"

WORKSHOP FOR HOME NURSING TRAINERS

On 16, 17 and 18 September 1952, Nursing Arts Instructors from JLCOM Hospitals, eighteen in all, participated in a three-day workshop at the US Army Hospital, held by Miss Ellen Aird, American Red Cross Consultant on Home Nursing, Washington, D. C.

The purpose of the workshop was to outline a teaching program designed to prepare civilian registered nurses, who are dependents of Armed Forces personnel in Japan, to become Instructors in the techniques of home nursing.

Objectives of the program are three-fold:

1. To teach wives and mothers the techniques of simple home nursing in cases of minor illnesses and injuries.
2. In event of disaster, will strive to allay fears among the dependents.
3. In event of disaster, will provide an additional source of trained workers to help in military hospitals.

In the areas concerned, burden of providing civilian nurses for the Nursing Arts Instructors rests with the Director, American Red Cross.

DOSAGE DILEMMA

Capt. Samuel Sarnar, MSC, USA, Tripler Army Hospital, Honolulu, T.H.

Pharmacists are frequently annoyed when the doctors write for a dosage that varies slightly from the usual stock item. This has happened to us many times at this hospital - not enough for us to stock the unusual dosage, but often enough to be annoying. Suddenly a solution presented itself - so simple that we blush to offer it, yet the thought prevails, that the device may have eluded others. We will use chloramphenicol as an example. This item is supplied in 250-mg. capsules. For the pediatric department we make a stock powder so that each No. 3 capsule weighs 0.24 gm. and contains 60-mg. of chloramphenicol. As the dosage of this drug is based on the weight of the patient, doses of 100-mg. are often prescribed. Such prescriptions always come in to the pharmacy at the peak of the day's activity. Locating the doctor for authorization to change the dosage is a time consuming chore and not always successful. Now instead of making a stock powder for the 100-mg. dose, we adjust the stock powder to the prescribed dose, using the following equation:

$$\begin{aligned} \left. \begin{array}{l} 60\text{-mg. (amount of drug)} \\ \text{by weight in unit dose of} \\ \text{stock powder) : 0.24 gm.} \end{array} \right\} &= \left\{ \begin{array}{l} 100\text{-mg. (amount of} \\ \text{drug by weight in} \\ \text{desired dose) : x} \end{array} \right. \\ 60x &= 24 \\ x &= 0.4 \text{ gm.} \end{aligned}$$

Using a No. 0 capsule containing 0.4 gm. of our stock powder, we get a 100-mg. dose. We fill the required

number of capsules and eliminate all fuss and bother. One stock powder will take care of various doses. The label on our stock bottle now reads:

Chloramphenicol Stock Powder

Chloramphenicol 60 gm.
Lactose q. s. ad. 240 gm.

For 60-mg. dose use No. 3 capsule (wt. 0.24 gm.)
For 75-mg. dose use No. 2 capsule (wt. 0.3 gm.)
For 100-mg. dose use No. 0 capsule (wt. 0.4 gm.)

Another example is pentobarbital for which 50-mg. is most often prescribed, but for which 30-mg. and 60-mg. doses are often written. A stock powder, based on the 50-mg. dose, is made.

Pentobarbital Stock Powder

Pentobarbital sodium 50 gm.
Lactose q. s. ad. 420 gm.

For 30-mg. dose use No. 2 capsule (wt. 0.28 gm.)
For 50-mg. dose use No. 1 capsule (wt. 0.42 gm.)
For 60-mg. dose use No. 0 capsule (wt. 0.56 gm.)

This formula can be used for other drugs subject to variations by the pharmacist, as dictated by the dosages of the drugs prescribed.

RECENT DEPARTMENT OF THE ARMY PUBLICATIONS

AR 15-480, 30 Jun 52: Boards, Commissions and Committees - Operations Research Office
AR 40-115, C-2, 23 Jul 52: Medical Department - Physical Standards and Physical Profiling for Enlistment and Induction
AR 40-440, C-1, 31 Jul 52: Medical Service-Army Medical Laboratories
AR 40-100, C-3, 11 Aug 52: Medical Service - Standards of Miscellaneous Physical Examinations
SR 615-180-5, 21 Jul 52: Enlisted Personnel -Summary of Registrant Examinations for Induction
SR 40-610-35, C-2, 6 Aug 52: Medical Service -Report of Treatment of Pay Patients
SR 31-100-10, 14 Aug 52: Subsistence Supply -Market Center - Discrepancy Tolerances in Shipments of Perishable Foods of Animal Origin
SR 605-145-25, 25 Aug 52: Officers-Administration of United States Naval Reserve Medical Corps and Dental Corps Officers Assigned to Duty with the Army
SR 40-590-42, C-2, 28 Aug 52: Medical Service-Admission to and Treatment in Medical Facilities, Department of the Army, Inside and Outside Contin-

ental U.S., of Personnel Entitled to Treatment at the Expense of the U. S. Public Health Service

SR 135-175-5, 29 Aug 52: Reserve Components - Separation of Officers
SR 140-105-9, 5 Sep 52: Organized Reserve Corps - Appointment as Reserve Commissioned Officers of Registrants under Universal Military Training and Service Act, as Amended, in Certain Army Medical Service Branches

DA Cir 63, 22 Jul 52: Sec II - Blood Grouping Serum, Anti-B, Liquid, 5cc

DA Cir 67, 6 Aug 52: Sec II - Payment of Army Members Hospitalized in the Continental U.S.; Sec. III - Temporary Promotions (Officer Personnel)

DA Cir 72, 18 Aug 52: Reduction of Enlisted MOS - Part XXVII of Appendix - Medical Career Field

DA Cir 74, 22 Aug 52: Sec III - Separation of Enlisted Members of Medical Holding Detachments

DA Cir 73, 21 Aug 52: Sec II - Procaine Penicillin G, for Aqueous Injection, 300,000 and 1,500,000 Units (Medical Stk Nbrs 1-607-400 and 1-607-410)

TECHNICAL

Report of Activities of Hemorrhagic Fever Field Unit	137
Hemorrhagic Fever.	143

REPORT OF ACTIVITIES OF HEMORRHAGIC FEVER FIELD UNIT*

THE distribution of the cases of hemorrhagic fever among the United Nations forces in Korea during May and June 1952, has shown certain well-defined characteristics which indicate the disease is what is known as a "place" infection. The vast majority of the cases have occurred in men stationed north of the 38th parallel, although a few cases have been from Yong Dung Po and other localities south of Seoul. No cases have been reported in American troops stationed in towns and cities and the disease is believed to be largely confined to the rural areas.

The vast majority of the cases have occurred as isolated events, widely scattered as to time, place and unit, with no obvious connection between them. However, from time to time the picture is characterized by small sharp outbreaks which have a very well defined pattern. These localized outbreaks vary in size from two or three to sixteen cases and, consistently, the time of onset of the cases is such as to indicate mass infection at approximately the same time, probably from a common source. Characteristically they are limited to certain platoons and squads to the exclusion of the rest of the company. They are not preceded or followed by other cases in the same company and no evidence is available to indicate that direct person to person transmission occurs. Similarly, the localization of cases to platoons and even squads is inconsistent with what would be expected if infection were through some common source of food or drink such as the company mess or water supply.

Further evidence that hemorrhagic fever is a "place" infection was also found in at least one instance when small outbreaks occurred in two companies which successfully occupied the same sector of the front line. The time of onset of the cases in the two companies indicated infection was acquired from the same area of the main line of resistance.

A spot map depicting the site of infection of cases admitted to the 8228th MASH shows a marked concentration of cases in certain sectors of the front line. This must be interpreted in the light of the distribution of troops throughout these areas. In general, the most cases come from those sectors which have the greatest concentration of troops. However, there is some indication that the men are more likely to be infected in the "Iron Triangle" area.

There appears to be a somewhat higher incidence of hemorrhagic fever in infantry and artillery units who live under more rugged field conditions with more exposure to nature than in the support units who usually live in semi-permanent camps. However, it should be pointed out that the semi-permanent camps are not by any means located in the same geographical areas as the combat troops and direct comparisons are hazardous since the difference may be one of locality

and not type of camp. In addition, it should be noted that many of the headquarters and service troops, while bivouacked in semi-permanent camps, work in the same areas as the combat troops.

The majority of the cases have come from units living in tents or bunkers located on hillsides from which scrub growth has been partially cleared and near which small streams flow. This type of bivouac area is almost universal in the forward areas and it is worthy of note that outbreaks have occurred in units camped on flood plains and in gun positions situated on the top of hills. The disease can therefore be contracted by men exposed to a wide diversity of types of terrain and, while the sources of infection appear to be highly localized, at the same time they are widely distributed in that part of Korea from Seoul north to the present line of battle.

It is not possible to make any statement regarding the relative incidence of hemorrhagic fever in ROK troops and other U.N. Forces because of the difference in medical services and facilities. It is known that cases and even deaths occur in the South Korean troops and, as would be expected, most of these have been in men enlisted from the southern portion of the peninsula. This indicates that South Koreans are susceptible but gives no indication of the susceptibility of the inhabitants of the "hot" areas north of Seoul. Among the non-native U. N. Forces, cases have occurred in British, Canadian, Australian, New Zealand, Ethiopian, Belgian, Puerto Rican, Columbian and Philippine troops, indicating general susceptibility.

While the general pattern of the epidemiology of hemorrhagic fever is fairly well understood, studies along this line should be continued. Of particular importance are the localized outbreaks which occur from time to time in certain companies. These are "key" events which should be thoroughly studied in an effort to unlock the sources of further knowledge of the vector and mode of transmission of this disease.

ENTOMOLOGICAL ASPECTS OF HEMORRHAGIC FEVER

Studies by the entomological group have been designed primarily to determine the ecology of the local areas which have been the site of infection for outbreaks of HF. By choice and necessity these studies have been closely integrated with epidemiological observations of other members of the Field Unit. With the exception of the Yong Dung Po area, which was associated with the outbreak among troops of the 539 QM Laundry Co., all sites investigated have been north of Seoul and most have been north of the 38th Parallel, in the Iron Triangle region. No particular attention was paid to towns and villages, since such

areas apparently are not connected with the disease in troops. For the most part the areas investigated were adjacent to occupied or abandoned temporary camp sites which were located along streams or on hillsides and lacked the facilities of a semi-permanent military installation. Small animals in the selected areas were collected at intervals by trapping and their ectoparasites were removed and classified.

Before presenting tabular data on the mammals trapped and their ectoparasites, as well as the possible relationship of the latter to the incidence of HF, a few general statements are indicated. In the areas under observation *Apodemus agrarius* was the most frequent mammal caught, irrespective of the type of terrain. It may be noted that trapping was not done inside inhabited areas, which might be expected to yield domestic rats and mice. The next most numerous rodent trapped was a *Microtus* (tentatively considered as *M. fortis*) which has as its preferred habitat the grassy areas along streams. *Clethrionomys* (a red-backed vole, species undetermined) and hamsters (tentatively placed in the genus *Cricetulus*) which are found on scrubby and rocky hillsides respectively, were the next most common mammals taken.

TABLE 1

Trombiculid mites (chiggers) and Laelaptid mites on *Apodemus agrarius* trapped in N. Korea 16 May to 2 July 1952.

Collection Dates	Total No. Mice Examined	Trombiculids		Laelaptids	
		Total No.	Aver. per mouse	Total No.	Aver. per mouse
16-19 May	17	239	14.0	8	0.5
23-26 May	29	262	9.0	46	1.6
27-30 May	17	211	12.4	68	4.0
2-5 Jun	31	301	9.7	49	1.6
6-9 Jun	10	6	0.6	31	3.1
10-13 Jun	42	24	0.6	69	1.6
16-19 Jun	35	21	0.6	67	1.9
21-24 Jun	45	39	0.9	92	2.0
26-29 Jun	38	5	0.1	119	5.0
30 Jun - 2 Jul	40	9	0.2	83	2.1

TABLE 2

Trombiculid mites (chiggers) on *Apodemus agrarius* and *Microtus* trapped in Chip'o-ri, Korea 16 May - 2 July 1952

Collection Dates	A P O D E M U S			M I C R O T U S		
	No. trapped	Total Chiggers Number	Aver. per mouse	No. trapped	Total Chiggers Number	Aver. per mouse
16-19 May	17	239	14.0	38	92	2.4
23-26 May	17	144	8.4	0		
27-30 May	10	200	20.0	3	5	1.6
2-5 Jun	31	301	9.7	4	69	17.2
6-9 Jun	10	6	0.6	3	30	10.0
10-13 Jun	0			1	37	37.0
16-19 Jun	0			1	0	0
21-24 Jun	5	1	0.2			
26-29 Jun			Not Trapped			
30 Jun - 2 Jul	5	1	0.2	1	0	0

However, the overall population of each of the two latter animals in the general area may have been greater than that of *Microtus*, since in the early part of the survey stream edges rather than hills were investigated.

Six areas were under regular surveillance from mid-May to July. However, approximately one-third of the total effort was devoted to the site at Chip'o-ri. Most of the available information on *Apodemus agrarius* and on *Microtus* and their trombiculid and laelaptid mites is summarized in Tables 1 and 2. It is apparent that the population of trombiculids on *Apodemus* was relatively high during the last half of May and early June and that it then dropped to a low level. This generality was true as regards the data for *Apodemus* from all six areas as well as from Chip'o-ri alone. During this same period the number of laelaptid mites remained fairly constant at a relatively low level. The data on *Microtus* infestation are hardly adequate for drawing conclusions but appear to correspond in general with those for *Apodemus*. The collections of *Clethrionomys* and hamsters have been too small to warrant any conclusions regarding their parasites. However, it is of interest that certain individual hamsters collected at Kumhwa in late June continued to carry large numbers of trombiculids (*T. orientalis*) and that *Clethrionomys* with fair regularity was heavily parasitized with chiggers, even during the dry spell. Thus, it seems likely that the variations in numbers of chiggers encountered on *Apodemus* and *Microtus* in the six areas followed the same general trends, influenced by meteorological and other conditions. However, the cyclic change may not affect each chigger species simultaneously since the various rodents prefer different environmental conditions.

The dominant chiggers collected in known infected areas during the survey conducted in May and June belong to the "akamushi group" (subgenus *Leptotrombidium*) of the genus *Trombicula*. One of the most common species on *Apodemus*, *Clethrionomys* and hamsters was *Trombicula orientalis* Schluger 1950, described from such hosts in eastern Siberia. A species near *T. (L.) pallida* regularly occurred in *Microtus*. A species near *T. (L.) scutellaris* was common on red-backed voles (*Clethrionomys*). Final taxonomic studies of the chiggers collected will be made in Washington. At least one of these chiggers (*T. orientalis*) seems to be restricted to the endemic area of eastern Siberia, Manchuria and Korea.

T. (L.) orientalis shows a predilection for attachment to the lower outer ear fringes of *Apodemus* and *Clethrionomys*, but on hamsters this mite has been found only deep in one of the ear lobes. The species near *T. scutellaris* has been found in the ear lobe and on the ear fringe.

It is worth noting that not infrequently when scores of trombiculids occurred in the ears of an individual mouse, all were of the same species and all in the same state of engorgement. At times only a few of the mice trapped alive at the same site during one night were heavily infested with trombiculids. This suggests that the distribution of North Korean chiggers is very spotty in nature and furthermore that an individual mouse may have encountered a single batch of unengorged chiggers which simultaneously infested the host.

According to unpublished data of Japanese scientists, chiggers increase both in number and kind during the fall and winter months in northern Japan. The unpublished records of the Preventive Medicine Companies

show that chiggers are fairly abundant on Korean rodents during the winter. It should be borne in mind that in Korea one is dealing with at least five species of chiggers, each of which, by analogy with the Japanese species, may have its own normal cycle of abundance throughout the year. The data both as to abundance and the identification of species, are as yet inadequate for determining these individual cycles.

Only two species of rodent fleas have been collected in the endemic areas thus far: Neopsylla bidentatiformis and a subspecies of Ctenophthalmus congener. The former is extremely uncommon, except perhaps on the hamster. C. congener, which ranges all over Europe and much of Asia, was found on every type of rodent examined, i.e., on Apodemus, Microtus, Clethrionomys, Mus, Rattus and the hamster. The majority of these mammals did not have any fleas, but as many as 12 Ctenophthalmus have been taken from one animal. The human flea, Pulex irritans, is said to be common in South Korea and we have observed it on at least one occasion on troops as far north as the 8228th MASH which was then located at Songu-ri. Fleas are relatively easily controlled by DDT and Lindane, used by most soldiers on their clothes and in sleeping gear. For these and other reasons fleas have not been seriously considered as vectors of HF.

RELATION OF ABUNDANCE OF CHIGGERS TO RAINFALL, ENVIRONMENTAL TEMPERATURE AND INCIDENCE OF HF

The entomological survey described above revealed a sharp variation in abundance of chiggers during the period studied. This was in contrast to the relatively constant low incidence of the other potential vectors under consideration, i.e., bloodsucking mites, fleas and ticks. The abundance of chiggers on Apodemus trapped in the areas under investigation is compared in the graph with daily temperatures and rainfall, environmental factors which affect the emergence of mites. The meteorological information was obtained for Uijongbu and may be regarded as generally representative for the area.

The heavy rains of April (over six inches of rainfall, making it the wettest April in 16 years) combined with the gradually rising temperature in April and May, provided conditions suitable at least for the emergence or maintenance of trombiculids of the akumushi group. These favorable factors could readily account for the abundance of chiggers at the beginning of the survey in mid-May. The gradually mounting heat of May and June combined with the protracted drouth, broken by occasional localized showers, undoubtedly contributed to the sharp decline of these mites on Apodemus and Microtus in mid-June. While such generalizations are probably valid, the data in the graph cannot be said to provide close correlation of chigger abundance with rainfall and temperature over short periods of time.

If trombiculids from Apodemus and Microtus are important vectors of HF, it would be anticipated that the incidence of disease would diminish sharply about two to three weeks after the mite population dropped precipitously. A slight indication of such an anticipated trend is apparent in the graph, which also shows by date of onset of disease the confirmed cases of HF treated at the 8228th MASH. The incidence data for the crucial period from 25 June to 5 July are incomplete at the time of this writing, but it is nevertheless apparent that the decline in cases has by no means been comparable with the sharp drop in the abundance of chiggers on Apodemus and Microtus.

DISCUSSION AND CONCLUSIONS

The accumulated evidence indicates that the vector of hemorrhagic fever is an arthropod of limited mobility distributed in localized foci throughout the area of Korea from Seoul north to the present front. While trombiculid mites cannot be definitely incriminated at this time the hypothesis that they are the vector is consistent with known fact and appears to be the most tenable one. It is true that little is known of the ecology of these chiggers in Korea and that the effect of rainfall and temperature upon their development must be worked out. Consequently much of our reasoning must be by analogy. Some of these defects in our knowledge will be resolved within the near future when it becomes possible to obtain more information on the rise and fall of the chigger population and its relation to the incidence of cases. Nevertheless, trombiculid transmission could readily explain the distribution of the cases of hemorrhagic fever, the vast majority of which occur as isolated cases scattered through many units. The situation is more complex when small sharp outbreaks occur limited to platoons, squads and even tents. The distribution of cases by day of onset in these outbreaks indicates infection at approximately the same time, of all those attacked. This is consistent with a trombiculid vector but if the outbreak were transmitted by laelaptid mites one would not expect simultaneous exposure of all cases. Furthermore, if Laelaps were the vector, such outbreaks would probably occur much more frequently than is the case and the disease would be expected to appear in the urban as well as in the rural areas.

The absence of any itching or indication of arthropod bites in hemorrhagic fever is notable. It should be pointed out that the chiggers found on rodents in Korea belong to a group which does not produce any reaction on humans and whose bite can readily pass unnoticed. This is the case in scrub typhus, transmitted by chiggers related to Korean species, in marked contrast with the chiggers found in the southern United States.

The reservoir of hemorrhagic fever is in all probability in some type or types of rodent. The Norway rat is very abundant in the area affected, particularly near the destroyed Korean villages. However, it is equally or more common elsewhere in the peninsula, particularly in the towns and cities, which are not affected by hemorrhagic fever. The same applies to the house mouse which has a similar distribution. Apodemus agrarius is the dominant rodent throughout the hemorrhagic fever area and is a habitant of the rural rather than the urban areas. Nevertheless the distribution of this rodent is much broader than the disease. On the other hand the red-backed vole (Clethrionomys) and the true vole (Microtus) and some of the Korean hamsters have distributions which correspond with that of the disease. They have been trapped in the neighborhood of all the foci studied and in some areas are abundant. They have been found to vary greatly with respect to ectoparasite population; while some are free of mites, fleas and chiggers, others caught close by are heavily parasitized. Judging from the damaged ear tissue of Microtus caught in late June it would appear that these voles carried many chiggers during the preceding period. Moreover, Clethrionomys trapped during May and June nearly always carried many trombiculids.

It is worth pointing out that Trombicula deliensis, one of the well studied vectors of scrub typhus, is unfavorably affected by prolonged heavy rains (monsoon season) as well as by drouth. One would suspect

that the rainy season, due in Korea in July and August, would have a suppressive effect on trombiculids. Hence, one would anticipate that the general trombiculid population would rise again in September and October prior to a reduction associated with cold weather. In order to study such ecological aspects of the selected hyperendemic areas it is planned that a team of technicians will continue work for several months in the specific areas which were under study during May and June.

SUMMARY

The control measures for terrestrial arthropods which have been instituted by the 8th Army and have been increasingly intensified, are potentially of great value in the prevention of hemorrhagic fever. However, maximum effectiveness can only be obtained by constant stimulation of interest of Medical Department personnel in close association with troops and by instruction of the combat personnel themselves.

Further studies on the rodents and arthropods which constitute the potential reservoirs and vectors of hemorrhagic fever are essential and should not be limited to short-range projects.

STUDIES ON THE AGENT OF HEMORRHAGIC FEVER

The experience of the Japanese and Russian workers has shown that HF was readily transmitted from man to man by means of injection of blood or urine taken during the first few days of the febrile phase of the illness. However, these groups of workers failed either to establish obvious disease in laboratory animals inoculated with infected material or to maintain it by serial transmission. Smorodintseff and his group thought that they might have produced transmissible disease in *Microtus michnoi*, but the agent was lost after a few serial passages. Moreover, Kitano and Kasahara, on one occasion, presumably elicited a sub-clinical infection in an *Apodemus agrarius* since the apparently normal tissues taken from this mouse in the fourth week after inoculation induced hemorrhagic fever in a volunteer. Both the Russian and Japanese investigators showed that the agent of HF was filtrable and their data were consistent with the idea that it was a small or medium size virus.

With such background information on the agent of HF, together with the epidemiological evidence suggesting an arthropod vector and a rodent host for the disease, the initial approach of the microbiological group of the HF Field Unit was directed to search for a viral agent which might be so adapted by serial passage that it would produce obvious disease in some laboratory animal. This developed along the following lines: Fresh blood, and in some instances marrow, was obtained at the 8228th MASH from febrile patients, usually within forty-eight hours of the onset of illness, and was injected by several routes into two strains of white mice, Syrian hamsters, *Microtus pennsylvanicus*, and cynomolgus monkeys. A series of blind passages was undertaken in the rodent and the primate hosts. Generally, this consisted of four passages (original and three serial passages) made at 4-6 day intervals in ordinary white mice (406th strain), two passages in monkeys, and a variable number of passages in *Microtus*. As regards the primates, the original animal of each series was bled on the 5th, 10th, and 15th day after inoculation and each blood specimen was injected into the same second passage monkey and also into different sets of white mice. On occasion, passages were made from the original animals of the special mouse stock (BS-

VS strain) and hamsters. In addition to the passage program just outlined, which was conducted at the 406th Medical General Laboratory, inoculated animals were sent to the AMGS and to Yale University. Tissues from mice and *Microtus* received at the AMGS were passaged at twelve day intervals for a total of four transfers and then inoculated into embryonated eggs; the inoculated cynomolgus monkeys were sent to Dr. Paul at Yale and passages were made there into rhesus monkeys.

The results obtained at the 406th Medical General Laboratory in the experimental animals injected with materials from the first thirteen confirmed cases of HF are summarized in Table 3. In no instance was a

TABLE 3

Number of Passages of Animals in Scheme I Inoculated with HF Material

Patient	Type	Inoculum Days of Disease Obtained	Mice		Syrian Hamsters	<i>Microtus</i> <i>pennsylvanicus</i>	Cynomol- gus Monkeys
			Local Swiss	BS-VS			
H-502	Blood	2	4	1	1	4	2
H-503	Blood; bone Marrow	2	7*6	2	1	3	2
H-504	Blood; bone Marrow	1	4	2	1	2	3
H-505	Blood	4	None	1	1	#	None
H-506	Blood	3	#4	1	1	#5	3
H-507	Blood; bone Marrow		**7	1	1	4	2
H-508	Blood	2,3	4	-	1	3	2
H-509	Blood	2	4	-	*4	-	-
H-511	Blood	3	#4	1	1	1	1
H-512	Blood	2	4	2	1	*3	2
H-518	Blood	2	3	-	1	-	2
H-519	Blood	1	3	-	1	-	-
H-520	Tissues Autopsy	6	3	-	1	-	2

*Tyzzler's disease; /Mouse Hepatitis; #Bacterial disease; **Ascitic Disease

transmissible disease established in the animals which has any resemblance to HF in man. Of even greater importance, no transmissible disease was encountered which failed to fall into the group of maladies encountered as natural infections of laboratory animals. Tyzzler's disease (*Bacillus piliformis* infection) was encountered on several occasions. Incidentally, this infection was not previously known to occur in hamsters or *Microtus*. Mouse hepatitis (Andrewes' virus) was noted in one instance and an undiagnosed disease characterized by ascites in another. The latter disease was suspected of being encephalitozoon in nature. Several types of bacterial infections were encountered in the animals. In brief, these extensive and laborious studies failed to accomplish their primary objective. However, they clearly indicated the need for disease-free animal stocks and steps have been taken to make such available in the theater.

Early in June, the original plan of study was altered and attention was turned to the use of embryonated eggs, suckling mice, and young guinea pigs as possible experimental hosts for the agent. Here again, fresh clinical and pathological material was inoculated at the 3228th MASH; in the case of guinea pigs

the inoculations were done often at the patient's bedside and the animals were brought to Tokyo for serial passage. It is still too early to evaluate this phase of the work. Bacterial infection in the guinea pigs interfered with the studies until animals from other breeders were obtained. A transmissible febrile illness has been maintained erratically in guinea pigs in several instances; one such line is now in its sixth passage. While this may prove to be of interest, we suspect that here too we are dealing with an undiagnosed epizootic disease.

Clinical or autopsy material from eighteen confirmed HF cases has been inoculated into embryonated eggs and the serial passages in each of these lines ranges from two to five. Experience with viral and rickettsial agents has shown that five or ten serial passages in chick embryos is often required before tangible evidence is obtained of multiplication of the microbes. This procedure will be followed in the egg work.

Inoculated guinea pigs and embryonated eggs are being taken back to the United States in order to complete the work in the home laboratories.

Brief mention should be made at this point of the results obtained to date in the two laboratories in the States which have been actively participating in the work of the Unit, i.e., Dr. John Paul's group at New Haven and the HF group in the Virus Department of the Army Medical School in Washington. In the former laboratory rhesus monkeys have proved no more susceptible than have cynomolgus monkeys in Tokyo. Four chimpanzees which were inoculated with frozen blood from Korean patients were still unaffected at the end of two and a half weeks. At the AMSGS rodent passage material from lines established with material from patients No. 501, 502 and 509 yielded a spirillum when transferred to embryonated eggs. This organism, which produces a fatal infection in eggs and usually elicits only inapparent disease in rodents, has not yet been identified. However, chemotherapeutic tests in eggs show that the organism is moderately susceptible to penicillin and chloramphenicol and quite susceptible to streptomycin. Preliminary neutralization tests in eggs using the spirillum and paired sera from the Korean HF cases gave negative results. Roller tube tissue cultures employing human tissues and animal passage material or acute phase blood from patients have been established in Washington and in New Haven.

Thus, the present status of the isolation studies may be summarized concisely as negative or incomplete. Further work will be done with the current passage lines in order to obtain a definitive answer regarding the relation of the presumably adventitious agents of the disease HF.

Clinical materials have been obtained and stored for future use by members of the Field Unit and other interested investigators. These consist of serial sera from approximately one hundred confirmed cases of HF. The three sera from each patient were obtained within the first few days of onset, at 2-3 weeks and at 4-6 weeks and have been maintained in the frozen state. In addition, whole blood was obtained during the first two days of illness from sixteen confirmed cases. This was frozen at the bedside and has been maintained at 70°. These two types of materials for future serological and isolation studies respectively are being taken back to Washington.

In reports about HF during the 1951 season, mention was made about anemia and hemorrhagic manifestations

of the disease that suggested blood parasites as the possible etiological agent. Later reports about the role of the rodent, *Apodemus agrarius* as a reservoir of the agent suggested that bartonella-like parasites should be sought as the etiological agent. Relatives of these rodents are known to be natural hosts for bartonella-like organisms such as *Hemobartonella*, *Grahamella*, and *Eperythrozoon*.

Subsequent studies to prove or disprove the presence of bartonella or bartonella-like parasites in HF patients were started in May 1952. Thick and thin blood films taken at periodic or daily intervals from twenty patients beginning at the time of admission were made and studied. Daily thin films of ten patients in our animal inoculation series were provided by the 8228th MASH. These studies failed to reveal the presence of bartonella or bartonella-like organisms. Culture media, including Geiman's solid medium for *Bartonella bacilliformis* and Fletcher's leptospira medium provided were inoculated with blood from ten patients taken during the first forty-eight hours after onset of the disease and from two patients at five and ten days after onset. These cultures were followed grossly and examined with the darkfield microscope for bartonella-like parasites and other organisms such as leptospira. No growth of detectable organisms was obtained in any cultures. These culture studies were controlled by transfer and heavy growth of known cultures of *Bartonella bacilliformis* (from Colombia, S.A.) to the same lots of media. To further eliminate the existence of bartonella-like organisms as the cause of HF, monkeys (*Macaca cynomologi* from the Philippines) receiving intraperitoneal and intravenous inoculation of blood from HF patients were inoculated intracutaneously in at least 2-4 sites on the supra-orbital ridge. This is the classical procedure to obtain verrugas in rhesus monkeys with *B. bacilliformis* of man. No fever or lesions developed during a 28 day period of observation. The blood of thirty of this lot of monkeys was examined for blood parasites by the thick and thin film technique with negative results before they were inoculated experimentally.

Agglutination studies with *B. bacilliformis* and sera from HF patients were planned but the above negative results caused the study to be discontinued. However, a *Grahamella* species was found in the blood of two *Apodemus agrarius* out of five examined, but it is doubtful if this organism bears any relationship to the agent of HF.

Several reports from last year mentioned the presence of specific bodies in the urine of patients with HF. Through the courtesy of 8228th MASH, the urine of twelve patients acutely ill with HF was examined for these bodies and a study was made to determine any possible resemblance to animal parasites. Permanent preparations were made for microscopical study by centrifuging the urine, making thin films of the sediment and staining with Giemsa stain. The bodies were found to be cellular, irregular in shape and with a nucleus and a distinctly elongate eosinophilic body of mass in the cytoplasm. No organisms of a parasitic nature could be defined.

After seeing acute cases of HF and an autopsy, microscopical studies of impression and scraping films made at autopsy were started. This work was initiated to test the hypothesis that HF has some resemblance to heart water fever of cattle and is the result of a focus of infection by visible parasites in the host, and that the disease results from the spread of toxic metabolic products by the blood leading to serious damage of the vascular bed and the

hemorrhagic phenomena characteristic of the disease. Films and tissues were obtained from ten autopsies out of which six series of films were adequate for study. In three series of films, intracellular rickettsia-like bodies were found in endothelial cells from the pituitary, inferior vena cava, adrenal glands, and splenic capsule. These morphologic entities do not appear to be related to the toxic granulation of polymorphonuclear leucocytes of the typical granules of mast cells of other normal granulocytes. The bodies were readily found in films from patients dying before five days but they were scarce or not present in patients dying eight days or more after onset. The finding of these rickettsia-like bodies was one of the basic reasons for the inclusion of guinea pigs and developing chick embryos in our later studies to isolate the etiological agent of HF. The significance of the bodies cannot be determined until experimental infection can be produced or in vitro cultivation achieved.

These studies were wholly dependent at all times upon the cooperation of the officers of the 8228th MASH for obtaining materials and on the staff of the 406th Medical General Laboratory for all its procedures carried out there. The team members acknowledge with warm appreciation the whole-hearted support of these men.

APPENDIX 1

THE USE OF ARTHROPODS AS EXPERIMENTAL ANIMALS IN CONNECTION WITH HF

The rickettsia-like bodies found in at least three autopsies represent a possible lead as to the etiological agent of HF. Whether they are actually the agent itself or are its products, they may turn out to be means of recognizing the presence of the causative organism.

In the present impasse which arises from the lack of any experimental animal in which obvious diseases can be produced by inoculating material from patients, it is suggested that arthropods be tried out as experimental animals in the hope that the agent may reveal itself either by lethal effect or by the production of rickettsia-like or other bodies in significant numbers. As background for such a procedure there may be cited the experience with the rickettsiae of epidemic typhus and of Q-fever, which on injection into meal-worms, *Tenebrio molitor*, cause the death of the insect (Weyer, about 1950). The organism of kala azar is capable of developing in the intestine of the common bedbug, an insect not involved in the natural transmission of the disease. Furthermore, in the experience of one of us, *Leishmania* injected into the body cavity of bedbugs and sandflies (*Phlebotomus*) are capable of developing and maintaining their virulence for a matter of weeks.

The technique of injecting insects and of withdrawing small quantities of fluid have been sufficiently worked out so that there should be no great technical problem in that behalf. The insect is temporarily immobilized with ether vapor and then held under the binocular dissecting microscope by various means. For injection, micro glass pipettes are used which are similar to those devised by M.A. Barbour in 1914 for the isolation of individual bacteria. The pipettes are provided with a rubber tube and mouthpiece. Fluids enter by capillarity and are expelled by blowing. All operations are of course carried out under the microscope. Since the opening of the pipette is very small the delicacy of control as to amount of

fluid and rate of injection or withdrawal is much greater than one unacquainted with the technique might imagine.

The arthropods chosen for inoculation should be those which can be easily and safely reared in the laboratory. Among the non-bloodsucking insects may be mentioned: Meal-worms (which have been used to a limited extent by this HF team), flour beetles (*Tribolium*), clothes-moths, wax-moths, "drugstore" beetles, dermestid beetles, cockroaches, *Drosophila*. Among bloodsucking insects, the common bedbug and several other species of *Cimex* are easily reared and support the process of inoculation very well. It must be borne in mind, however, that this whole group is invariably infected with its own "rickettsia" which, in the absence of a pathological effect, might be confusing. Mosquitoes are easily injected and even an insect as small and delicate as *Phlebotomus* could be employed. Ticks would lend themselves very well for this general purpose. It is obvious that the potential arthropod vectors of HF should also be included in the inoculation program, even to the extent of using wild-caught specimens. In the case of chiggers, the small size of the larvae might offer difficulties but the nymphs and adults could probably be injected, although the writers have had no personal experience with injecting members of this group. Adult laelaptids and fleas should offer no insuperable difficulty.

The inoculated insects would be kept alive as long as possible, with the sacrifice of a certain proportion at regular intervals, examination to be made by smears and/or sections. Techniques for the preparation of histological sections from minute insects or bits of tissue are available. Any lethal or other pathological effect would be duly exploited. Suspensions of inoculated arthropods could be injected into laboratory animals, including Korean species suspected as reservoirs, in the hope that the effect of passage in the insect body - activation, stage of organism or whatever - might lead to obvious infection of such animal.

The classical procedures of feeding arthropods on patients, which would be used in any transmission experiments could be extended so as to include a number of bloodsucking insects not necessarily suspected as natural vectors, and which might thus serve as experimental animals. It is possible that the agent would multiply in the arthropod to the point of becoming demonstrable by causing infection in birds or mammals by subsequent feeding or inoculation. If an obligatory cycle in an arthropod is involved this might be the only means of isolation. Trombiculid and laelaptid mites, hard and soft ticks, lice, fleas and mosquitoes reared in the laboratory and fed on healthy mammals are suggested as appropriate for such a project.

*EDITOR'S NOTE: This report of activities of the Hemorrhagic Fever Field Unit was prepared by its members: Dr. Ross L. Gauld, Epidemiologist; Dr. Quentin M. Geiman, Parasitologist; Dr. Marshall Hertig, Entomologist; Dr. Joseph E. Smadel, Virologist; Dr. K. C. Smithburn, Virologist; and Lt. Colonel Robert Traub, MSC, Entomologist. Dr. J. P. Craig, Epidemiologist, and Capt. E. L. Buescher, MC, Virologist, of the 406th Medical General Laboratory, and Capt. W. E. Lawrence, MSC, Mammalogist, and Capt. T. Harriess, MSC, Entomologist, of the special unit from the Office of the Surgeon General, assigned on temporary duty to the 406th Medical General Laboratory, participated extensively in the studies.

HEMORRHAGIC FEVER

Captain William H. Kessler, MC, and Captain William F. Ganong, MC*
8228th Mobile Army Surgical Hospital, APO 301

HEMORRHAGIC FEVER is considered to be an acute infectious disease, probably of viral or rickettsial origin, characterized by fever, headache, backache, an erythematous flush, conjunctival and palatal injection, hemorrhagic manifestations, vaso-motor instability, albuminuria and renal insufficiency.

ETIOLOGY: At present the etiology is unknown. Epidemiologically and clinically, however, hemorrhagic fever behaves like an infectious disease. Attempts by American investigators to isolate an etiologic agent and to transmit the disease to experimental animals, have thus far been unsuccessful. On the other hand, Russian and Japanese workers have reported successful transmission to human volunteers by injection of infected blood, urine, and tissue extracts, as well as material from infected mites. The Japanese report that the etiologic agent passes a Berkfeld 20# filter, suggesting that it is a virus or small rickettsia.

EPIDEMIOLOGY: The disease has a seasonal incidence with spring and fall outbreaks. Although sporadic cases occur throughout the year, the case rate rises in May, reaches a peak in June, then declines during the summer months. In October the case rate again rises precipitously and reaches its height in November. During December the case rate falls and cases are infrequent during late winter and early spring.

The Russians and Japanese have reported hemorrhagic fever in Manchuria and eastern Russia. The 1951 and 1952 outbreaks in United Nations troops have been limited to central Korea, particularly the Chorwon, Kumwha, and Yonchon areas. In Korea, it has been predominantly a disease of front-line troops and it occurs most commonly in personnel whose duties require them to work in grassy and scrub terrain. Small focal outbreaks are seen; thus, for example, three or four cases may occur in one squad while the remainder of the company escapes unaffected. This type of case distribution suggests a non-flying insect vector. There is no evidence of person to person transmission.

These observations support the Japanese and Russian claims that the disease is mite-borne. Trombiculid mites are suspected though no specific species has been incriminated by American entomologists. At any rate, the bite of the vector does not produce local irritation and there is no eschar.

Foreign literature indicates a reservoir of inapparent infection in field rodents, particularly *Apodemus agrarius*.

The changes in other organs are less striking. A relatively common finding is hemorrhage into the wall of the right atrium. Epicardial petechiae, and sub-endocardial ecchymoses are found less commonly. The lungs show vascular congestion, and rarely, edema and intrapulmonary hemorrhage. The gastric mucosa is intensely hyperemic and at times hemorrhagic. The adrenals are usually normal but may show lipid depletion and small hemorrhages. Except for microscopic focal necrosis, the liver is also normal and no consistent changes are found in the brain.

INCUBATION PERIOD: The incubation period is usually two to three weeks but may range from seven to thirty-five or more days.

CLINICAL PICTURE: Hemorrhagic fever varies greatly

in severity but the majority of the patients follow a relatively typical course. This course, for descriptive purposes, is best divided into four phases. The disease begins with fever and non-specific constitutional symptoms, the febrile phase. In three to five days the temperature falls and at this time many patients show twelve to thirty-six hours of hypotension. This hypotensive phase is followed by three to five days of oliguria and azotemia, and terminates in a diuresis, which initiates the prolonged convalescent phase. The hemorrhagic manifestations begin in the febrile phase, reach their maximum during the hypotensive period and disappear while the patient is still oliguric.

FEBRILE PHASE: An irregular high fever is characteristic of the first four days of this disease. The usual first symptom is headache followed rapidly by malaise, anorexia, chilly sensations and a rising temperature. The headache is severe and usually frontal. Frequently retro-orbital pain, aggravated by ocular movements, is also present. Malaise is especially prominent and is associated with restlessness and weakness, myalgia and lumbar headache. Chills, or chilly sensations, may be the initial symptoms but more frequently appear four to twelve hours after onset. The temperature rise is rapid, and reaches 102°F or more on the first day in over 90% of the cases. Irregular high fever (101°F-106°F) persists until the onset of hypotension. Lumbar backache is present in twelve to twenty-four hours and becomes progressively worse throughout the febrile phase. Anorexia occurs early and progresses to nausea and vomiting on the third or fourth day of illness, particularly in overhydrated patients, but vomiting is rarely seen in the first forty-eight hours. Thirst is prominent and leads to excessive fluid intake. A few patients notice several soft stools on the first or second day of illness but the vast majority have no change in bowel habits. Late in the febrile phase, steady, unlocalized abdominal pain appears and may be severe.

Other important but less common symptoms include blurred vision, nasal congestion, and dizziness due to postural hypotension. A mild dry non-productive cough is common, but never severe.

PATHOLOGY: The basic pathologic process appears to be diffuse capillary damage with capillary dilation, increased capillary fragility and permeability of the vascular system with transudation of plasma into loose areolar tissues. This leads to hemoconcentration, inadequate circulating blood volume, hypotension and hemorrhage. Anatomically, the most striking changes are seen in the kidneys and the pituitary. The kidneys are large and edematous. The cut surface presents a striking contrast between the cortex and pyramids. The cortex is pale yellow with petechiae and focal congestion, while the pyramids are dark red and hemorrhagic. Microscopically, changes in the cortex are minimal but the pyramidal areas show intense capillary congestion, necrosis of the tubular epithelium and hemorrhage. The anterior lobe of the pituitary shows congestion, necrosis and hemorrhage, which in 75% of the cases is extreme.

The two most typical early physical findings are facial flush and injection of the conjunctiva and palate. The flush is a diffuse erythema involving the skin of the face, neck and upper anterior chest and resembles a first degree sunburn. The injection begins in the palpebral conjunctiva and rapidly spreads to the bulbar areas. It is fine, diffuse, reticulated and not associated with a purulent exudate. The

palatal injection is similar and is more prominent posteriorly.

Petechiae are uncommon before the third day. They appear first on the soft palate and in the axillary folds. Subsequently they may occur in the conjunctiva, on the chest, and at sites of trauma.

Edema of the bulbar conjunctiva and the periorbital tissues may become apparent on the third or fourth day. Diffuse lymphadenopathy begins to appear on the second day. These nodes remain small and nontender. Splenomegaly and hepatomegaly are rare.

Transient meningismus is seen in a few cases on the second and third days. Costovertebral angle tenderness is not prominent in spite of the severe backache. Muscle guarding and tenderness to deep palpation may be present in those patients with abdominal pain but rigidity and spasm are not present.

HYPOTENSIVE PHASE: Significant clinical shock appears in approximately 25% of hemorrhagic fever patients. With the onset of hypotension the temperature usually falls by rapid lysis. In severe cases the temperature fails to fall, this is considered a poor prognostic sign. Shock is commonest on the fifth or sixth day but may appear as early as the third. It lasts from a few hours to three days or longer. Significant hypotension is absent in the remaining 75% of the cases and these patients pass directly into the oliguric phase.

Shock is heralded by apprehension, restlessness and sometimes diaphoresis. The headache disappears but backache, vomiting and abdominal pain increase. Blurred vision of a myopic type is often prominent. In the more severe patients progressive mental deterioration occurs with confusion, delirium, coma, and occasionally convulsions.

The physical findings in shock are manifestations of wide spread capillary damage. Falling pulse pressure and rising pulse rate characterize this period. The diastolic pressure is maintained initially, thus readings such as 100/80, 90/80, and 86/82 are typical. A thready, weak pulse usually persists, but in severe cases blood pressure and peripheral pulse are unobtainable, the neck veins collapse, and heart sounds are weak and rapid, with an apical rate of 160/min. or more. Conjunctival edema increases in proportion to the degree of vascular damage. Petechiae appear in increasing numbers, ecchymoses develop at sites of needle puncture, and hematemesis may occur. Early, the extremities are dry and warm in spite of hypotension but later cyanosis and vascular stasis appear and the extremities become cold.

In the non-fatal cases these changes regress. The pulse slows, the blood pressure rises and the pulse pressure widens. The edema is slowly reabsorbed and hemorrhagic manifestations lessen.

OLIGURIC PHASE: Urinary output decreases sharply at the end of the febrile phase and oliguria or occasionally anuria persists for two to six days. The severity of the renal phase is independent of the hypotensive period and severe azotemia may be seen in patients who never show hypotension.

The symptoms of this phase are those of acute azotemia. Often the patients become irritable, restless and sometimes combative. Vomiting may become a problem. Hiccoughs are common and may become intractable. Neuromuscular hyperexcitability is evident

and may progress to tetany. Abdominal pain and backache, on the other hand, regress as the edema is reabsorbed unless the patient is overhydrated.

The blood pressure rises during oliguria, usually to mild hypertensive levels, but it may reach 200/120 and be associated with encephalopathy and convulsions. Bradycardia is common. Uremic frost, pericarditis, diarrhea, and the hyporeflexia and weakness of hyperkalemia may occur in the more severe cases.

CONVALESCENT PHASE: The oliguric phase terminates in a profuse diuresis, usually about the tenth day of illness. In the majority, symptoms rapidly subside and convalescence begins. Appetite returns, strength and lost weight is regained. Because of impaired renal concentrating ability polyuria persists. The contracting ability of the kidneys gradually improves, returning to normal in five to six weeks. This period of time may be as short as two weeks or as long as three months. The severity and duration of the renal involvement determines the length of convalescence.

LABORATORY DATA: Albuminuria and hyposthenuria are constant findings in hemorrhagic fever. During the febrile phase the urinary specific gravity varies between 1.025 and 1.032. During hypotension and oliguria it falls gradually reaching 1.010 at the time of diuresis. In the first week of convalescence, specific gravities of 1.004 to 1.008 are common. Concentrating ability, however, returns slowly and is usually the last laboratory test to return to normal. Albuminuria appears suddenly on the third to sixth day and persists until early convalescence. Hematuria may be a manifestation of the hemorrhagic diathesis. It appears microscopically on the third to the fifth day and may progress to gross bleeding during oliguria.

The white blood count is normal in the first three days of illness. Usually on the fourth day the count rises reaching levels of 20,000 to 30,000 WBC per cu. mm on the seventh or eighth day. In severe cases counts of 50,000 to 60,000 WBC per cu. mm are not uncommon and counts up to 100,000 WBC per cu. mm have been observed. The white blood count then falls slowly reaching normal levels during the convalescent period. The differential count shifts to the left with the appearance of metamyelocytes and myelocytes before the total count begins to rise. This shift becomes more pronounced until the peak of leucocytosis is reached. On the 4th to 5th day the lymphocyte count rises and many atypical lymphocytes appear. Failure of these cells to appear is felt to indicate a poor immune response and is a bad prognostic sign. The count returns to normal in convalescence.

The hematocrit is closely correlated to the clinical course of hemorrhagic fever, reflecting diffuse capillary damage and transudation of plasma. It rises slowly during the febrile period. In the hypotensive phase a sudden rise of 10 points or more is usual, and levels of 60 or 65 are common. As the blood pressure rises the hematocrit falls. This decrease in hematocrit continues in the oliguric phase reaching normal levels before diuresis. As the urine output increases there may be a mild secondary rise in the hematocrit. A fall to mildly anemic levels sometimes appears in convalescence, but this anemia corrects itself without specific therapy. Hemoglobin levels follow hematocrit levels. Occasionally nucleated erythrocytes are seen in the peripheral smear during the acute phase.

The hemorrhagic diathesis is characterized by increased capillary fragility, prolonged bleeding time and thrombocytopenia. Coagulation time and prothrombin levels are usually normal although clot retraction may be poor. The Rumpel-Leeds test becomes positive on the third to fourth day and reverts to normal in the oliguric phase. Platelet depression appears on the fourth day, reaches a maximum on the sixth or seventh day and returns to normal levels during oliguria.

The erythrocyte sedimentation rate is normal throughout the febrile period but rises sharply during the oliguria and early convalescence. It falls slowly and reaches normal at about the time of return or normal renal concentrating ability.

Azotemia increases rapidly during oliguria. Because of fever and low caloric intake, catabolism is marked. This leads to liberation of large quantities of nitrogenous wastes, phosphates and potassium. Therefore, blood urea nitrogen levels of 250 mgm%, phosphate levels of 8-10 mgm%, and potassium levels of 6-8 mg/L can appear during a relatively brief period of oliguria. Calcium levels are usually depressed and may reach tetanic levels. Interestingly, acidosis is mild if present, chloride levels are not depressed unless vomiting has been protracted, and usually the serum sodium is only slightly depressed. Hyperkalemia, on the other hand, is not uncommon and is associated with characteristic electrocardiographic changes. With the onset of diuresis, creatine levels drop promptly although the BUN and NPN continue to rise for one or two days. In a minority of cases bizarre electrolyte changes complicate diuresis, but usually chemical abnormalities are promptly corrected. Data on liver function tests, protein fractionation pattern, specific electrocardiographic changes and steroid excretion are not available.

DIAGNOSIS: At present there is no specific diagnostic test for hemorrhagic fever. The diagnosis is therefore based on the sum of clinical and laboratory findings. At the Hemorrhagic Fever Center the following criteria are thought to be essential:

Clinical history and physical findings consistent with hemorrhagic fever.

Hemorrhagic manifestations.

Significant albuminuria.

Although milder cases which do not meet these three criteria probably occur, they cannot be diagnosed at present.

Diseases most commonly confused with hemorrhagic fever are malaria, upper respiratory infections, infectious mononucleosis, relapsing fever, gastro-enteritis, infectious hepatitis and meningitis.

COMPLICATIONS: Complications are largely due to the hemorrhagic diathesis. Hematemesis, melena, intrapulmonary hemorrhage, gross hematuria, severe epistaxis and intracranial hemorrhage may occur, but are rare in patients who are not overhydrated. Bronchopneumonia, pulmonary abscesses, ruptured spleen, hemorrhagic pancreatitis, bacterial parotitis and cerebral abscess have been encountered.

PROGNOSIS: The case fatality rate among United States troops treated at the Hemorrhagic Fever Center is approximately 4%. Serious prognostic signs are prolonged high fever, early appearance of shock, se-

vere hemorrhagic manifestations, rising temperature during shock, failure of a lymphocytosis to appear, marked leucocytosis, and severe electrolyte disturbances. There are no known residua and there have been no proved recurrences.

TREATMENT: At present there is no specific therapeutic agent for hemorrhagic fever. Management is based on careful fluid restriction, bed rest and sedation. Fluid limitation is based on three observations: 1) overhydration increases abdominal pain; 2) mobilization of excessive edema fluid during oliguria when vascular permeability returns to normal may lead to pulmonary edema; 3) excessive edema may aggravate shock. Therefore, the presence of conjunctival or periorbital edema, vomiting, or severe back pain indicates overhydration and fluid intake is limited. In many patients this produces a moderately negative water balance but improvement in symptoms is prompt and dehydration is well tolerated. On the other hand when overhydration is not a clinical problem fluids may be allowed to the point of equaling urine output plus insensible water loss. When the capillary damage is repaired during oliguria, the edema is reabsorbed and during the remainder of the renal phase the patient is kept in normal fluid balance. With the onset of diuresis negative water balance must be avoided and it is therefore often necessary to force fluids.

It has been amply demonstrated that keeping these patients quiet lessens bleeding, vomiting, shock, and morbidity. Therefore, prompt air evacuation, strict bed rest and adequate sedation are routinely employed. Because it is both analgesic and hypnotic, meperidine hydrochloride has been of great value and is used liberally, even when pain is minimal. This drug relieves headache, backache, abdominal pain, vomiting and hiccoughs, and produces sleep.

Alcohol sponges, ice packs and small doses of antipyretics are used to control hyperpyrexia, but large doses of acetylsalicylic acid are to be avoided.

Management of the hypotensive phase is directed at maintaining an effective blood pressure without overhydrating the patient until the integrity of the cardiovascular system has been restored. Trendelenburg position and the use of elastic bandages on the lower extremities are effective and these measures alone will control mild to moderately severe cases of shock. Vasoconstrictors are also helpful. Concentrated human serum albumin (salt poor) is of great value in severe shock, because it increases intravascular osmotic pressure, drawing fluid into the vascular system and reducing hemoconcentration. It loses its effectiveness after repeated use, however, presumably because it leaks into the tissues itself. Human plasma has been used but this requires large quantities of fluid resulting in increased edema. Whole blood may be effective in reducing shock. Its disadvantages are: (1) transfusion reaction; (2) red cell lysis leads to increased danger of hyperkalemia, and (3) the fluid volume required would also result in increased edema. Apprehension and hyperventilation during shock are difficult to manage. Constant reassurance and small quantities of sedatives are beneficial.

Therapy during the oliguric phase is essentially that of acute renal insufficiency from any cause. Careful fluid and electrolyte balance is maintained. Intake should be high in calories in order to reduce endogenous protein catabolism. Diet should be high in carbohydrate and fat but low in protein, sodium

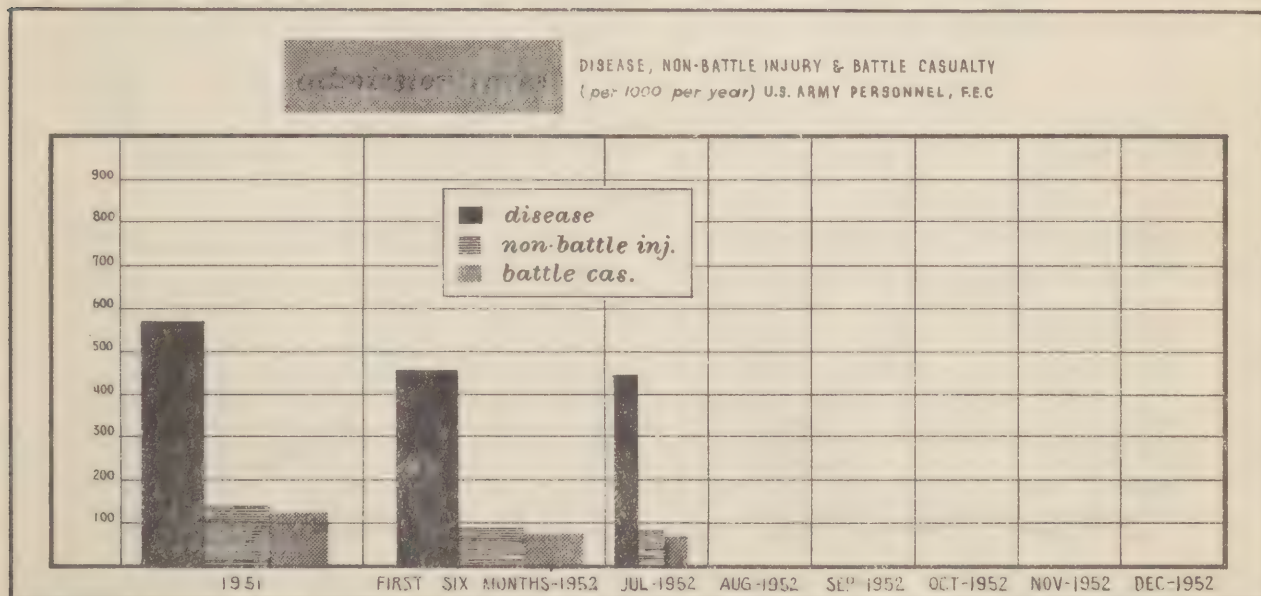
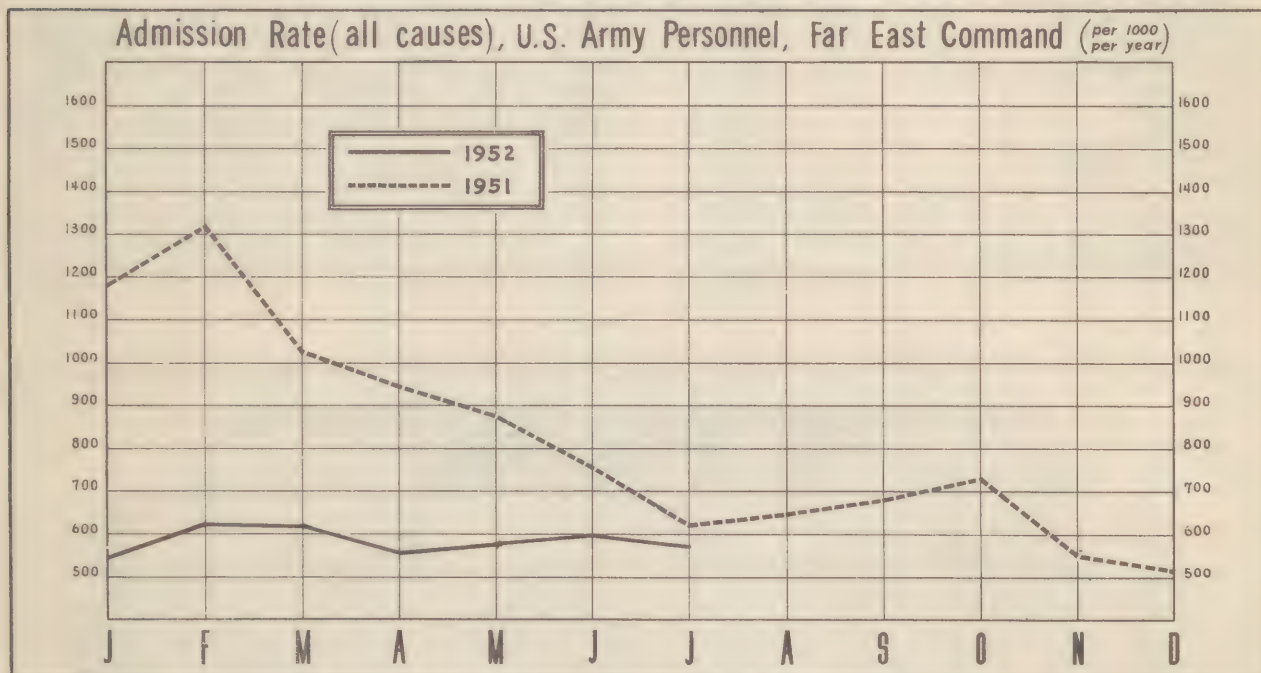
and potassium. Hypertonic glucose solutions are useful for these reasons. Large amounts of calcium may be necessary to correct hypocalcemia. Hyperkalemia responds temporarily to hypertonic glucose and insulin, hypertonic saline and calcium. Cation exchange resins and hemodialysis (artificial kidney) have been employed in a few cases.

Except for maintaining adequate fluid and electrolyte intake little therapy is needed after diuresis begins. It is important, however, to keep these patients in bed until azotemia and albuminuria have

disappeared. At this time graded ambulation may be initiated. The rare serious electrolyte disturbances encountered in diuresis must be handled on an individual basis.

PROPHYLAXIS: Preventive measures are directed at the mite. Dipping clothes after every 2-3 washings in dibutylphthalate and/or benzylbenzoate, use of insect repellent on the boot tops, belt line and hands, and avoiding areas of heavy underbrush whenever possible are thought to be effective in prophylaxis. There is no immunizing agent available at present.

HEALTH OF ARMY TROOPS, FEC

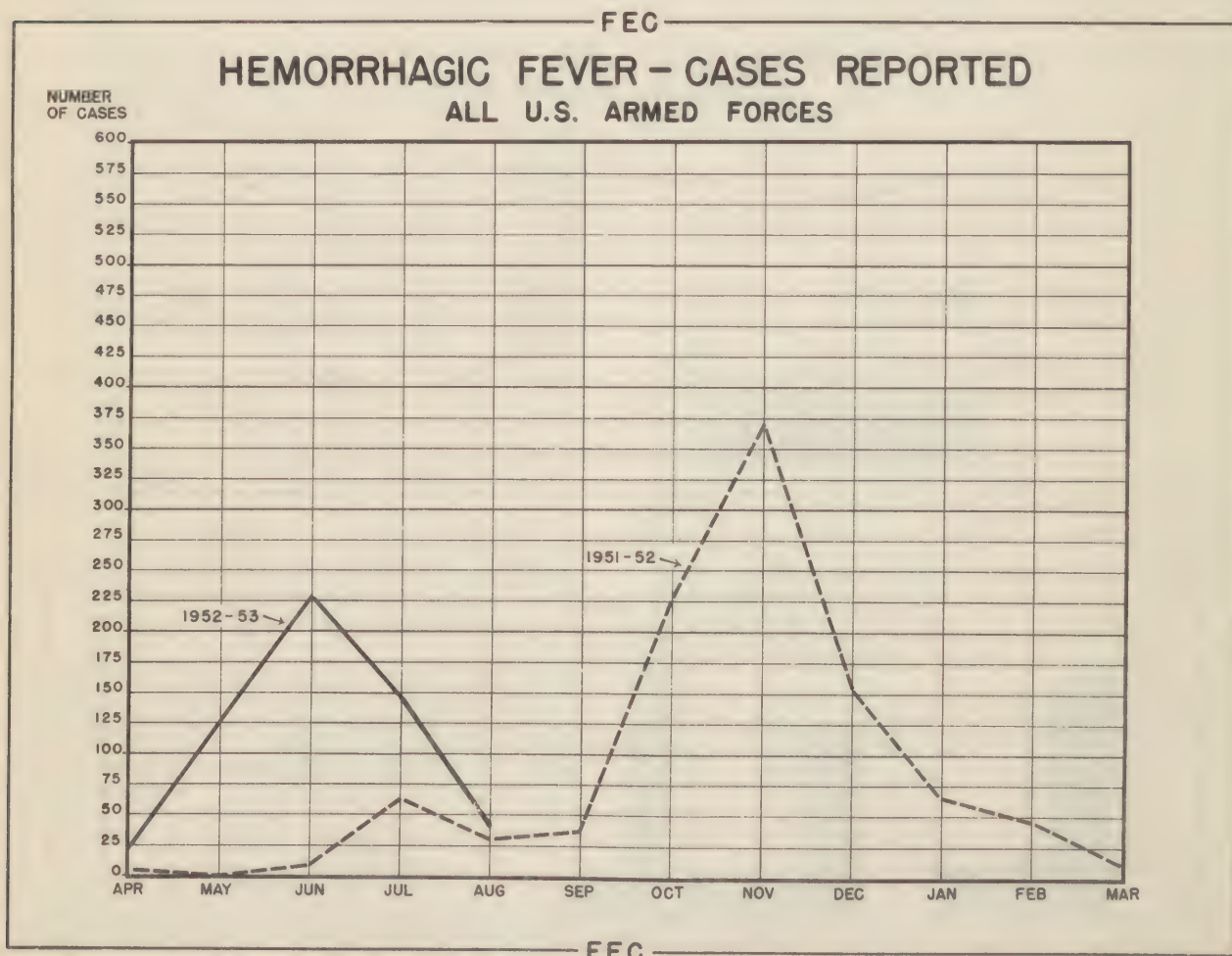


Admissions per 1,000 troops per annum, Army personnel, for the five-week period ending 30 July 1952 were as follows:

	<u>FEC</u>	<u>JAPAN</u>	<u>KOREA</u>	<u>PHILCOM (AF)</u>	<u>RYCOM</u>
All Causes	570	524	599	353	414
Diseases	441	465	435	316	366
Nonbattle Injuries	86	60	99	37	47
Battle Casualties	43	0	65	0	0
Psychiatric	23	14	27	7.3	17
Common Cold and Respiratory Disease	57	77	48	22	60
Influenza	2.2	0.8	2.8	0	1.8
Primary Atypical Pneumonia	1.9	1.1	2.4	0	0.85
Bacillary Dysentery	2.1	0	3	7.3	1.8
Amebiasis	0.61	0.70	0.61	0	0
Food Poisoning	2.5	0.20	3.6	0	0
Malaria, New	23	0	34	22	4.4
Dermatophytosis	9.5	13	8	7.3	7.9
Rheumatic Fever	1.7	0.1	0.26	0	0
Venereal Disease	188	181	195	95	136
Meningitis	0.06	0.1	0.04	0	0
Polioyelitis	0.2	0.3	0.13	0	0.88
Encephalitis	0.12	0	0.13	0	0.88
Hepatitis, Infectious	5.6	5.6	5.5	7.3	9.6
Hemorrhagic Fever	4.1	0	6.2	0	0

DAILY NON-EFFECTIVE RATE

All Causes	18	34	11	30	10
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Health of the Far East Command for the month of July 1952 refers to Army personnel only.

ADMISSION RATES:

All Causes: The health of the Army, in the Far East Command, continued to be good during July 1952, with a 5% reduction in the "All Causes" admissions to hospitals and quarters being reported, with a rate of 570 admissions per 1000 strength per year. This decline, with minor exceptions, was reflected in each major admission category as well as in each subordinate command.

Diseases: The incidence dropped slightly (2%) in FEC to a rate of 441/1000/annum. Japan and RYCOM both contributed to this decline while Korea's rate increased 1%, largely due to a mild increase in the incidence of bacillary dysentery. Poliomyelitis made a seasonal appearance in each command with 7 cases reported among Army personnel (Japan 3, Korea 3, and RYCOM 1). The incidence of infectious hepatitis and malaria showed virtually no change since June. Malaria is repeating the 1951 pattern in which June and July were almost identical high points for the year. Neuropsychiatric conditions and upper respiratory infections showed slight declines in each command.

Nonbattle Injuries: Admissions declined 7% to a FEC rate of 86, solely as the result of a substantial reduction in Korea which overbalanced increases in Japan and RYCOM. The ratio of injuries caused by motor vehicle accidents (one out of every 17 injury admissions) and athletics (one out of 12) reflected improvement over previous experience. A comparison of the admission rates for Korea and Japan is shown below:

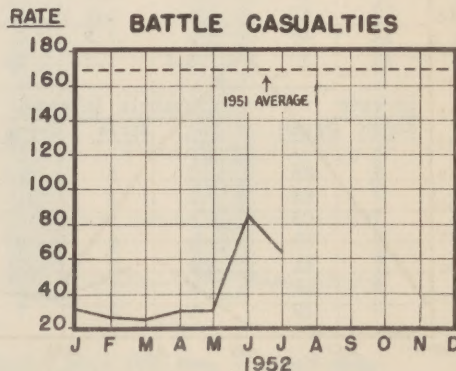
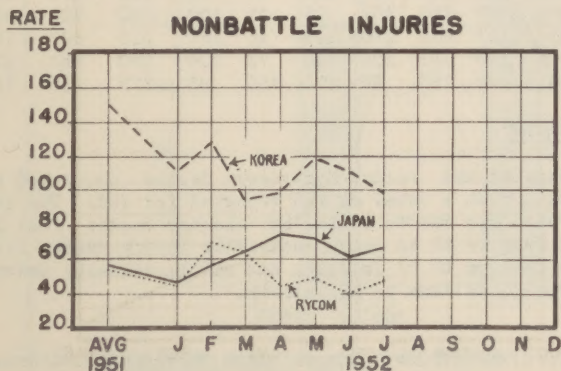
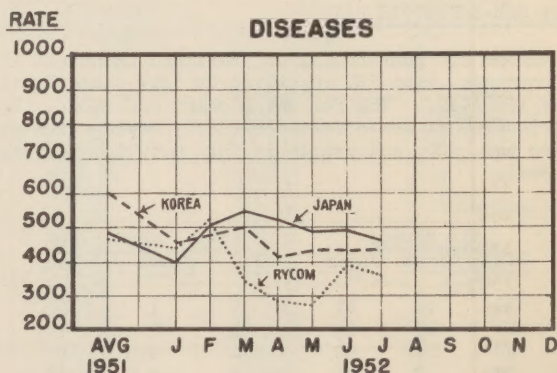
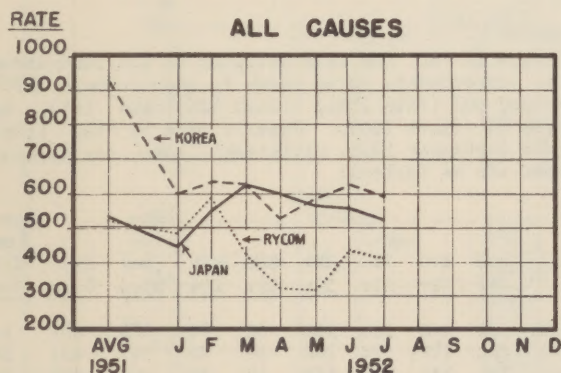
	ADMISSION RATES					
	Motor Vehicle Accidents			Athletic Injuries		
	FEC	Korea	Japan	FEC	Korea	Japan
Jan	6.9	9.0	2.9	2.3	1.6	3.4
Feb	7.9	10.7	3.3	2.9	.9	6.2
Mar	6.3	8.1	3.7	4.5	2.7	7.1
Apr	7.4	9.1	5.0	6.6	6.5	7.3
May	8.4	10.7	4.2	10.9	11.9	9.8
Jun	7.0	8.7	3.6	10.7	11.7	9.7
Jul	7.7	6.6	3.4	7.7	7.1	9.3

Battle Casualties: Although still running well ahead of the casualties during the first five months of this year, combat wounds and injuries reported in July declined 25% from June's high, to a rate of 65/1000/annum.

FEC

ADMISSION RATES - U.S. ARMY ALL MEDICAL TREATMENT FACILITIES

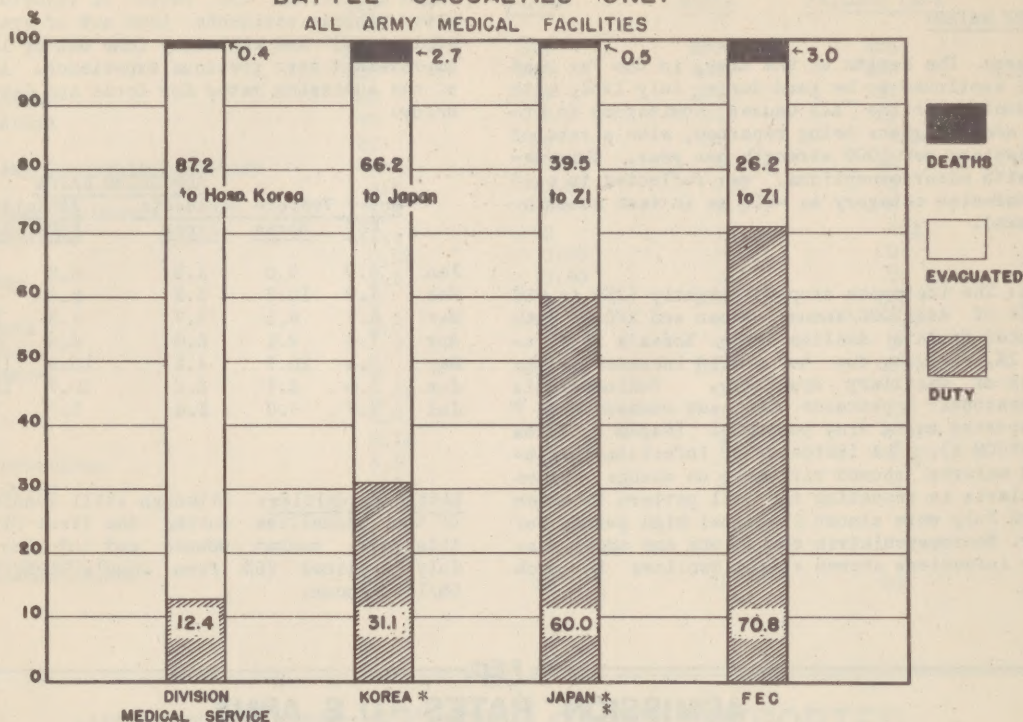
ANNUAL RATES OF ADMISSIONS TO HOSPITAL AND QUARTERS PER 1000 STRENGTH



FEC

FEC

DISPOSITION OF ARMY PATIENTS BATTLE CASUALTIES ONLY



* INCLUDES DIVISION EVACUATIONS PLUS DIRECT ADMISSIONS TO NON-DIVISIONAL MEDICAL FACILITIES.
 * INCLUDES KOREAN EVACUATIONS PLUS DIRECT ADMISSIONS TO JAPAN MEDICAL FACILITIES.

FROM 1 JULY 1951 thru 30 JULY 1952

FEC

DAILY NON-EFFECTIVE RATES:

The number of non-effectives remained unchanged in all commands, with FEC reporting an "All Causes" rate of 18/1000/day. The following chart indicates the distribution of non-effectives (daily average number of men per 1000 not available for duty for medical reasons):

disease in FEC, the rate dropping to 188/1000/annum, with improvements being shown in each command. RYCOM dropped 40% (rate 136), Japan 33% (rate 181), and Korea 9% (rate 195). Japan's rate is the lowest since September 1951. Divisional rates for Korea and Japan are as follows:

	All Causes			Battle Casualties		
	FEC	Korea	Japan	FEC	Korea	Japan
Jan	24	10	51	5	1	12
Feb	22	11	44	3	1	7
Mar	20	11	40	2	0.6	5
Apr	18	9	36	2	0.8	4
May	17	10	32	2	1.5	4
Jun	18	11	35	2	1.3	5
Jul	18	11	35	3.5	1.5	9

	Disease			Nonbattle Injuries		
	FEC	Korea	Japan	FEC	Korea	Japan
Jan	14	7	28	5	3	11
Feb	14	7	26	5	3	11
Mar	13	7	25	5	3	10
Apr	12	7	23	4	2	9
May	11	7	21	4	2	7
Jun	12	8	22	4	2	8
Jul	11	8	19	4	2	7

DISEASES

Venereal Disease: Strenuous control measures resulted in a substantial decline (18%) in venereal

	2nd Div	3rd Div	7th Div	25th Div	40th Div	45th Div	Korea (less Div)	Japan (less Div)
Jan	159	132	194	183	82	73	273	454
Feb	323	169	178	166	66	65	247	431
Mar	191	142	210	134	17	48	226	478
Apr	97	154	187	74	45	100	260	491
May	127	263	176	129	46	132	322	502
Jun	153	192	109	138	73	108	290	481
Jul	129	138	88	121	108	93	272	283

DEATHS:

Hospital and carded-for-record deaths increased in July, with a total of 113 reported for FEC. The increase was due to a rise in disease deaths from 16 in June to 25 in July, nonbattle injury deaths from 40 in June to 57 in July, and battle casualty deaths from 25 in June to 31 in July.

HOSPITALIZATION: (These data cover all patients, Army, Air Force and others).

The bed status as of 30 July 1952 was as follows:

	Designated Beds	Operating Beds	All Patients Army Hospitals	Average Beds Occupied	
				Army Patients	
				USAF Hospitals	Navy Hospitals
Japan	12,750	10,335	4,199	97	4
Korea	5,140	5,021	2,693	7	4
PHILCOM (AF)	0	0	0	39	0
RYCOM	400	347	186	0	0
	18,290	15,703	7,078	143	8

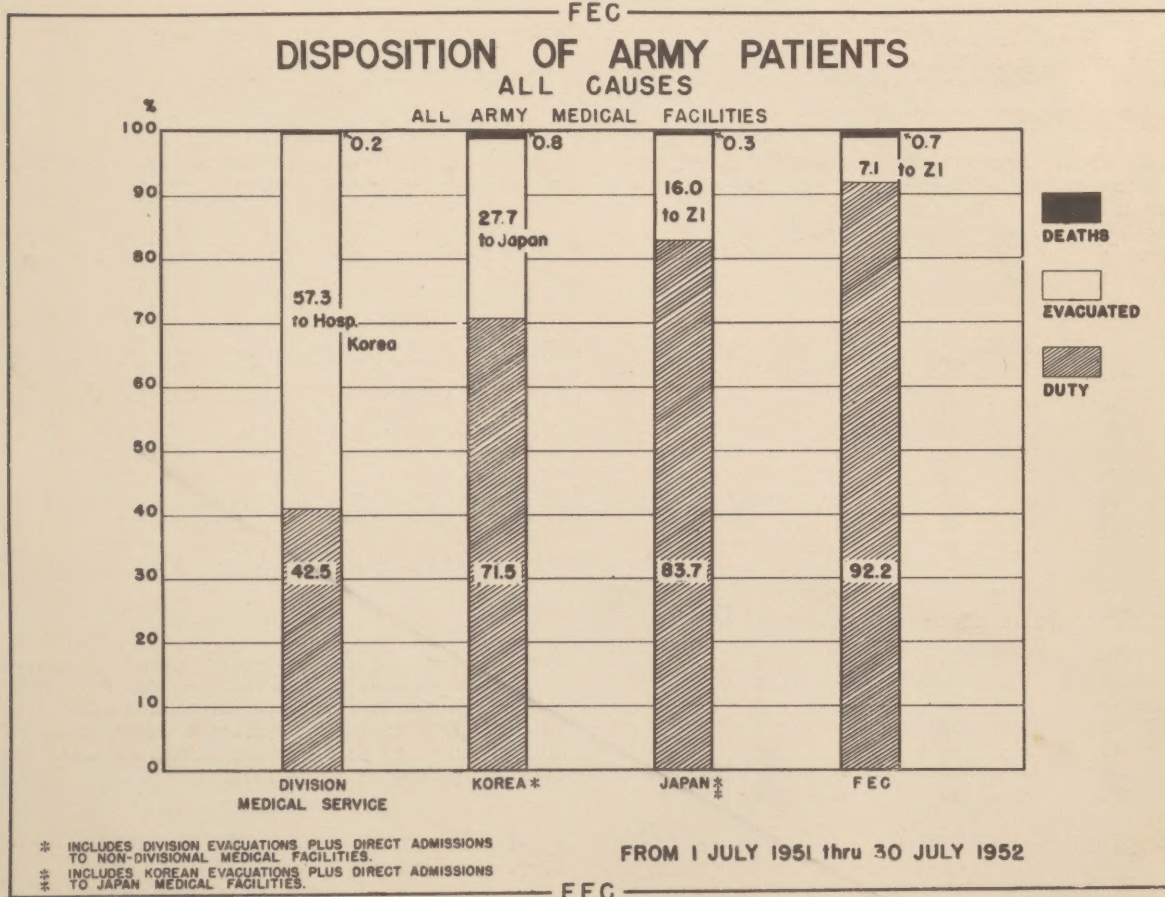
In Korea, there were 11,750 PsW operating beds, 6,038 of which were occupied by PsW and 1,033 occupied by civilian internees.

The percent of designated beds and operating beds in Army hospitals occupied as of 30 July 1952 was as follows:

	Percent of Designated Beds Occupied	Percent of Operating Beds Occupied
Japan	33	41
Korea	52	55
RYCOM	47	54
FEC	39	45

EVACUATION: Tabulated below is the number of patients evacuated from the major commands during the five report weeks ending 30 July 1952:

	Evacuated to the Zone of Interior			Other United Nations Personnel Evacuated to Their Homelands
	Army Personnel	Others	Total	
Japan	900	68	968	144
PHILCOM (AF)	2	0	2	-
RYCOM	40	27	67	-
	942	95	1,037	144



UNCLASSIFIED



The Chief Surgeon extends an invitation to all Far East
Command medical personnel of the U. S. Army, Navy and Air Force,
or of the United Nations, to prepare and forward
with view to publication, articles of professional or
administrative nature. It is assumed that editorial privilege
is granted unless author states otherwise.

Capt. Charles A. Copeland, MSC EDITOR

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